INSPECTION
OF
LOADING AND UNLOADING HOSES
FOR
PETROLEUM PRODUCTS

OISD-STD-135

Oil Industry Safety Directorate
Government of India
Ministry of Petroleum & Natural Gas
8th Floor, OIDB Bhavan, Plot No. 2, Sector – 73, Noida – 201301 (U.P.)
Website: www.oisd.gov.in
Tele: 0120-2593800, Fax: 0120-2593802
INSPECTION
OF
LOADING AND UNLOADING HOSES
FOR
PETROLEUM PRODUCTS

Prepared By:
COMMITTEE ON INSPECTION OF STATIC EQUIPMENT

OIL INDUSTRY SAFETY DIRECTORATE
8th Floor, OIDB Bhavan, Plot No. 2, Sector – 73, Noida – 201301 (U.P.)
Website: www.oisd.gov.in
Tele: 0120-2593800, Fax: 0120-2593802
Preamble

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain – upstream, midstream and downstream – Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry, Oil Industry Safety Directorate (OISD) was set up in 1986 Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits.

In more than 25 years of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards – starting with research by in-house experts and iterating through seeking & validating inputs from all stake-holders – operators, designers, national level knowledge authorities and public at large – with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD – except in the Upstream Petroleum Sector – is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self-regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of International and national level Knowledge Organizations – both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

Executive Director
Oil Industry Safety Directorate
FOREWORD

The Oil Industry in India is 100 years old. Because of various collaboration agreements, a variety of international codes, standards and practices have been in vogue. Standardisation in design philosophies and operating & maintenance practices at a national level was hardly in existence. This, coupled with feed back from some serious accidents that occurred in the recent past in India and abroad, emphasised the need for the industry to review the existing state of art in designing, operating and maintaining oil and gas installations.

With this in view, the Ministry of Petroleum and Natural Gas in 1986 constituted a Safety Council assisted by the Oil Industry Safety Directorate (OISD) staffed from within the industry in formulating and implementing a series of self regulatory measures aimed at removing obsolescence, standardising and upgrading the existing standards to ensure safe operations. Accordingly, OISD constituted a number of functional committees of experts nominated from the industry to draw up standards and guidelines on various subjects.

The present document on “Inspection of loading and Unloading Hoses for Petroleum Products” has been prepared by the Functional Committee on “Inspection of Static Equipment”. This document is based on the accumulated knowledge and experience of industry members and the various national and international codes and practices. This document is meant to be used as supplement and not as a replacement for existing codes and practices. It shall be borne in mind that no standard can be a substitute for the judgement of a responsible qualified Inspection Engineer. Suggestions are invited from the users after it is put into practice to improve the document further. Suggestions for amendments to this document should be addressed to

The Co-ordinator,
Committee on “Inspection of Static Equipment”,
OIL INDUSTRY SAFETY DIRECTORATE
8th Floor, OIDB Bhavan, Plot No. 2, Sector – 73, Noida – 201301 (U.P.)

This standard in no way supersedes the statutory requirements of bodies like IBR, CCE, Factory Inspectorate or any other Government Body which must be followed as applicable.
NOTE

OISD publications are prepared for use in the oil and gas industry under the Ministry of Petroleum and Natural Gas. These are the property of Ministry of Petroleum and Natural Gas and shall not be reproduced or copied and loaned or exhibited to others without written consent from OISD.

Though every effort has been made to assure the accuracy and reliability of data contained in these documents, OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from their use.

These documents are intended only to supplement and not replace the prevailing statutory requirements.

Note 3 in superscript indicates the modification/changes/addition based on the amendments approved in the 19th Safety Council meeting held in September, 2001/July, 1999.
**COMMITTEE ON**
**INSPECTION OF STATIC EQUIPMENT**

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANISATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LEADER</strong></td>
<td></td>
</tr>
<tr>
<td>Shri R. K. Sabharwal</td>
<td>Indian Oil Corporation (Refineries &amp; Pipelines)</td>
</tr>
<tr>
<td>Shri Y. P. Ajmani</td>
<td>Oil &amp; Natural Gas Commission</td>
</tr>
<tr>
<td>(Since March, 1993)</td>
<td></td>
</tr>
<tr>
<td><strong>MEMBERS</strong></td>
<td></td>
</tr>
<tr>
<td>Shri B. Ravi</td>
<td>Indian Oil Corporation (Marketing)</td>
</tr>
<tr>
<td>Shri S. F. Kanchwala</td>
<td>Bharat Petroleum Corporation Limited (Refineries)</td>
</tr>
<tr>
<td>Shri G. Somani</td>
<td>Indian Oil Corporation(Refineries &amp; Pipelines)</td>
</tr>
<tr>
<td>Shri S. S. Murthy</td>
<td>Hindustan Petroleum Corporation Limited, Visakh Refinery</td>
</tr>
<tr>
<td>Shri S. Neelakantan</td>
<td>Madras Refineries Limited</td>
</tr>
<tr>
<td>Shri R. Rehman</td>
<td>Hindustan Petroleum Corporation Limited (Marketing)</td>
</tr>
<tr>
<td><strong>MEMBER COORDINATOR</strong></td>
<td></td>
</tr>
<tr>
<td>Shri K. R. Soni</td>
<td>Oil Industry Safety Directorate</td>
</tr>
</tbody>
</table>

In addition to the above, various other experts from the industry contributed in the preparation, review and finalisation of this document.
INSPECTION OF LOADING AND UNLOADING HOSES FOR PETROLEUM PRODUCTS

CONTENTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>DESCRIPTION</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Introduction Note 3</strong></td>
<td></td>
</tr>
<tr>
<td><strong>PART A:</strong></td>
<td>HOSES FOR ROAD &amp; RAIL TANKER</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>SCOPE</td>
<td>1</td>
</tr>
<tr>
<td>2.0</td>
<td>TYPES OF HOSES</td>
<td>1</td>
</tr>
<tr>
<td>3.0</td>
<td>MATERIAL &amp; CONSTRUCTION OF HOSES</td>
<td>1</td>
</tr>
<tr>
<td>4.0</td>
<td>INSPECTION &amp; TESTING OF HOSES DURING MANUFACTURE</td>
<td>1</td>
</tr>
<tr>
<td>5.0</td>
<td>INSPECTION &amp; TESTING OF NEW HOSES PRIOR TO USE</td>
<td>2</td>
</tr>
<tr>
<td>6.0</td>
<td>PERIODIC INSPECTION &amp; TESTING OF HOSES</td>
<td>2</td>
</tr>
<tr>
<td>7.0</td>
<td>DOCUMENTATION</td>
<td>3</td>
</tr>
<tr>
<td>8.0</td>
<td>REFERENCES</td>
<td>3</td>
</tr>
<tr>
<td><strong>PART B:</strong></td>
<td>HOSES FOR LPG SERVICE</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>SCOPE</td>
<td>4</td>
</tr>
<tr>
<td>2.0</td>
<td>TYPES OF HOSES</td>
<td>4</td>
</tr>
<tr>
<td>3.0</td>
<td>CONSTRUCTION OF HOSES</td>
<td>4</td>
</tr>
<tr>
<td>4.0</td>
<td>MATERIAL OF CONSTRUCTION</td>
<td>5</td>
</tr>
<tr>
<td>5.0</td>
<td>INSPECTION &amp; TESTING OF HOSES DURING MANUFACTURE</td>
<td>5</td>
</tr>
<tr>
<td>6.0</td>
<td>INSPECTION &amp; TESTING OF NEW HOSES PRIOR TO USE</td>
<td>6</td>
</tr>
<tr>
<td>7.0</td>
<td>PERIODIC INSPECTION &amp; TESTING OF HOSES</td>
<td>6</td>
</tr>
<tr>
<td>8.0</td>
<td>DOCUMENTATION</td>
<td>7</td>
</tr>
<tr>
<td>9.0</td>
<td>REFERENCES</td>
<td>7</td>
</tr>
<tr>
<td><strong>PART C:</strong></td>
<td>MARINE HOSES FOR OFFSHORE TERMINALS</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>SCOPE</td>
<td>8</td>
</tr>
<tr>
<td>2.0</td>
<td>TYPES OF HOSES</td>
<td>8</td>
</tr>
<tr>
<td>3.0</td>
<td>GENERAL REQUIREMENTS</td>
<td>9</td>
</tr>
<tr>
<td>4.0</td>
<td>MATERIAL &amp; CONSTRUCTION OF HOSES</td>
<td>9</td>
</tr>
<tr>
<td>5.0</td>
<td>INSPECTION AND TESTING OF HOSES DURING MANUFACTURE</td>
<td>10</td>
</tr>
<tr>
<td>SECTION</td>
<td>DESCRIPTION</td>
<td>PAGE</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>6.0</td>
<td>PERIODIC INSPECTION AND TESTING OF HOSES</td>
<td>11</td>
</tr>
<tr>
<td>7.0</td>
<td>HANDLING AND STORAGE OF HOSES</td>
<td>13</td>
</tr>
<tr>
<td>8.0</td>
<td>DOCUMENTATION</td>
<td>14</td>
</tr>
<tr>
<td>9.0</td>
<td>REFERENCES</td>
<td>14</td>
</tr>
</tbody>
</table>

**PART D: HOSES FOR JETTY OPERATIONS**

<table>
<thead>
<tr>
<th>SECTION</th>
<th>DESCRIPTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>SCOPE</td>
<td>15</td>
</tr>
<tr>
<td>2.0</td>
<td>TYPES OF HOSES</td>
<td>15</td>
</tr>
<tr>
<td>3.0</td>
<td>MATERIAL AND CONSTRUCTION OF HOSES</td>
<td>15</td>
</tr>
<tr>
<td>4.0</td>
<td>INSPECTION &amp; TESTING OF HOSES DURING MANUFACTURE Note 3</td>
<td>15</td>
</tr>
<tr>
<td>5.0</td>
<td>PERIODIC INSPECTION &amp; TESTING OF HOSES</td>
<td>16</td>
</tr>
<tr>
<td>6.0</td>
<td>INSPECTION AND TESTING OF HOSES PRIOR</td>
<td>16</td>
</tr>
<tr>
<td>7.0</td>
<td>TO USE</td>
<td>16</td>
</tr>
<tr>
<td>7.0</td>
<td>STORAGE AND HANDLING</td>
<td>16</td>
</tr>
<tr>
<td>8.0</td>
<td>DOCUMENTATION</td>
<td>17</td>
</tr>
<tr>
<td>9.0</td>
<td>REFERENCES</td>
<td>17</td>
</tr>
</tbody>
</table>

**ANNEXURE-I** GENERAL GUIDELINES FOR STORAGE AND HANDLING OF HOSES IN PETROLEUM SERVICE (EXCLUDING MARINE HOSES) 18

**ANNEXURE-II** GENERAL PROCEDURE FOR HYDROTESTING OF HOSES 19

**ANNEXURE-III** PROCEDURE FOR HYDROTESTING OF MARINE HOSES 20

**ANNEXURE-IV** PROCEDURE OF VACUUM TEST FOR MARINE HOSES 21

**ANNEXURE-V** FLOAT HYDROSTATIC TEST (MARINE HOSES) 22
"INTRODUCTION" Note 3

This standard comprises of 4 parts as follows:

Part A : Hoses for Road and Rail Tanker
Part B : Hoses for liquefied petroleum gas (LPG) service
Part C : Marine Hoses for Offshore Terminals
Part D : Hoses for Jetty operations

Definitions:

Tank Trailer : a vehicle with a tank mounted thereon or built as integral part thereof and constructed in such a manner that it has at least two axles and all its load rests on its own wheels.

Tank Truck : a single self-propelled vehicle with a tank mounted thereon.

Tank Wagon : a Railway Carriage with a tank mounted thereon."
PART A

HOSES FOR ROAD AND RAIL TANKER

1.0 SCOPE

This section covers the requirements and methods of sampling/testing of electrically bonded road and rail tanker hoses, resistant to petroleum and blended products, having maximum 25% aromatic hydrocarbon content and suitable for -25 deg C to 65 deg C working temperature range. Inspection/testing of new hoses and periodic inspection of hoses in service have been discussed separately.

2.0 TYPES OF HOSES

The hoses used in the Petroleum Industry are of the following types:

2.1 TYPE-1A

Type-1A hoses are rough bore hoses, with internal and external helical wire reinforcement, corrugated outer cover and for a maximum working pressure of 3.5 Kg/Cm2.

2.2 TYPE-1B

Type-1B hoses are smooth bore hoses with embedded helical wire reinforcement, plain or corrugated outer cover, used for a maximum working pressure of 3.5 Kg/Cm2.

2.3 TYPE-2A

Type-2A hoses are rough bore hoses similar to type-1A, used for a maximum working pressure of 7.0 Kg/Cm2.

2.4 TYPE-2B

Type-2B hoses are smooth bore hoses similar to type-1B, used for a maximum working pressure of 7.0 Kg/Cm2.

2.5 TYPE-3

Type-3 hoses are smooth bore reeling hoses without helical wire reinforcement, used for a maximum working pressure of 7.0 Kg/Cm2.

3.0 MATERIAL AND CONSTRUCTION OF HOSES

Construction of hoses & materials for lining, reinforcement, helical wire, electrical bonding, cover and end connections shall be as per IS-10733.

4.0 INSPECTION AND TESTING OF HOSES DURING MANUFACTURE

The following inspection checks and testing shall be carried out as per IS-10733.

i) Visual inspection
ii) Checking of mass and dimensions/ tolerances
iii) Tensile strength and elongation at break for the lining and cover.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
iv) Accelerated Ageing Test
v) Adhesion Test
vi) Swelling Test
vii) Test for soluble matter.
viii) Test for resistance to vacuum.
ix) Hydrostatic pressure test.
x) Bursting pressure test.
x) Electrical bonding checks.

5.0 INSPECTION AND TESTING OF NEW HOSES PRIOR TO USE
i) All hoses shall be serially numbered for maintaining service records.
ii) Hoses shall be inspected for the following
   - Dimensional check-up.
   - The hose cover for cracks, tear, puncture, abrasion or any other damage.
   - Couplings for cracks or any other deformity.
   - Liner for defects and physical damages from both ends.
iii) Hoses shall be hydrostatically tested to the designated pressure.
iv) Hoses shall be checked for electrical continuity.

6.0 PERIODIC INSPECTION AND TESTING OF HOSES

6.1 PERIODICITY

Each hose shall be inspected/tested after 6 months of initial operation. Subsequent testing shall be done at 3 months interval irrespective of the number of operations. However each hose shall be visually checked for damage every time prior to use.

6.2 VISUAL INSPECTION AND DIMENSIONAL CHECKS

Detailed inspection as per Para 5.0(ii) shall be carried out during each periodic inspection.

6.3 HYDROSTATIC TESTING

6.3.1 Elongation during hydrotecting

Hoses shall be subjected to hydrostatic testing at designated test pressure. Elongation under working pressure shall not exceed 5% for type-3 hoses and 10% for all other hoses. Permanent elongation for all hoses shall not exceed 2.5%.

6.3.2 Test procedure

Test shall be carried out as per procedure given in IS-10733.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
6.4 ELECTRICAL CONTINUITY

Hoses shall be checked for Electrical Continuity after each hydrotesting.

7.0 DOCUMENTATION

Records of the observations, tests, remarks etc. in respect of each hose shall be suitably maintained. These records shall show all details pertaining to origin and manufacture, identification, service history, inspection and maintenance etc. of the hose.

8.0 REFERENCES

i) IS-10733-Specification for Electrically Bonded Road and Rail Tanker Hose of Rubber, Resistant to Petroleum Products.

ii) BS-3492- Electrically Bonded Road & Rail Tanker Hose and Hose assembly for Petroleum Products.
PART B

HOSES FOR LIQUEFIED PETROLEUM GAS (LPG) SERVICE

1.0 SCOPE

This section covers the requirements and methods of sampling/testing of hoses and hose assemblies complete with end connections for transferring Liquefied Petroleum Gas (LPG) for loading tank trucks/tank wagons, limited for use at temperatures between -25 deg C to 65 deg C, working pressure upto 25 Kg/Cm² and size upto 102 mm nominal bore. Metallic hoses for unloading of LPG from tankers are excluded.

2.0 TYPES OF HOSES

2.1 TYPE-1 :

Wire Braided Reinforced Hose upto and including 76 mm nominal bore.

2.2 TYPE-2 :

Textile (including Metallic Cord) Reinforced Hose upto and including 76 mm nominal bore.

2.3 TYPE-3 :

Textile Reinforced Hose with wire helix and built-in couplings, 76 mm and 102 mm nominal bore.

3.0 CONSTRUCTION OF HOSES

The constructional details of various types of hoses mentioned in Para 2.0 are as given below. Hoses shall be uniformly Vulcanised and reasonably concentric throughout its length.

3.1 TYPE-1

i) An inner lining of synthetic rubber resistant to L.P.G.

ii) A reinforcement consisting of layers of braided wire as necessary. If more than one layer is used, each shall be separated by an insulating layer of rubber.

iii) An outer cover of synthetic rubber resistant to abrasion, atmospheric exposure and to LPG.

iv) Both lining and cover shall be smooth, uniform, free from porosity and other defects.

3.2 TYPE-2

i) An inner lining of rubber resistant to LPG.

ii) Reinforcement plies of textile in cord, woven or braided form or metallic cord where reinforcement is of textile material, two or more electrical bonding wires of corrosion and fatigue resisting material each of not less than 9 strands shall be provided.

iii) An outer cover of synthetic rubber resistant to abrasion, to atmospheric exposure and to LPG.

iv) Both lining and cover shall be smooth, uniform, free from porosity and other defects.

"OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines."
3.3 **TYPE-3**

i) An inner lining of rubber resistant to LPG.

ii) Reinforcement plies of textile in cord or woven form or metallic cord together with at least one helix of heavy steel wire embedded in rubber.

iii) An outer cover of synthetic rubber resistant to abrasion, atmospheric exposure and to LPG.

iv) Both lining and cover shall be smooth, uniform, free from porosity and other defects.

4.0 **MATERIAL OF CONSTRUCTION**

4.1 **LINING & COVER**

The rubber shall meet the following requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>Lining</th>
<th>Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength, min.</td>
<td>100kgf/cm²</td>
<td>100kgf/cm²</td>
</tr>
<tr>
<td>Elongation at break, min.</td>
<td>150%</td>
<td>150% min.</td>
</tr>
<tr>
<td>Tensile strength after ageing, min</td>
<td>75% of unaged value</td>
<td>75% of unaged value</td>
</tr>
<tr>
<td>Elongation at break, min.</td>
<td>75% of unaged value</td>
<td>75% of unaged value</td>
</tr>
<tr>
<td>Swelling in n-pentane max.</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Soluble matter max.</td>
<td>5%</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Low temperature flexibility</td>
<td>No cracking at -20°C</td>
<td>No cracking at 20°C</td>
</tr>
</tbody>
</table>

4.2 **WIRE REINFORCEMENT**

The steel wire braid quality in Type-1 hoses shall be as agreed between the purchaser and the manufacturer. The steel wire used in Type-3 hoses shall be hard drawn or hard rolled with a tensile strength of not less than 70 kgf/mm², galvanized or coppered.

5.0 **INSPECTION AND TESTING OF HOSES DURING MANUFACTURE**

The hoses shall be subjected to the following tests during manufacture:

i) Visual inspection

ii) Dimensional check.

iii) Tensile strength and elongation at break for lining & cover in unaged and aged conditions.

iv) Swelling test

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
v) Test for fuel soluble matter
vi) Low temperature flexibility
vii) Pressure Tests.
   a) Proof Test
   b) Burst Test
viii) Electrical continuity test

6.0 INSPECTION AND TESTING OF NEW HOSES PRIOR TO USE

i) All hoses shall be serially numbered for maintaining service record.

ii) Hoses shall be inspected for the following:-
   - Dimensional check.
   - Hose cover for cracks, tear, puncture, abrasion or any other damage.
   - Coupling for any cracks or sign of abuse.
   - Check the ends of the assembly for irregularities in liner.
   - Check for electrical continuity.

iii) Hoses shall be hydrostatically tested at the designated test pressure as per clause 7.3.1.

7.0 PERIODIC INSPECTION AND TESTING OF HOSES

7.1 PERIODICITY

LPG hoses shall be inspected & tested at maximum interval of 4 months.

7.2 VISUAL INSPECTION AND DIMENSIONAL CHECKS

Inspection specified in Para 6.0(ii) shall be carried out.

7.3 HYDROSTATIC TESTING

7.3.1 Test Pressure

Hydrostatic testing of LPG hoses at periodicity outlined in Para 7.1 shall be at a pressure equal to the highest of the following:

i) Maximum shut-off pressure of the system.

ii) Set pressure of any safety valve provided in the system.

iii) 1.5 times of maximum working pressure.

7.3.2 Test Procedure

The hose shall be placed on a test table or plain surface so as to lie straight, without twist. The surface on which the hose rests should be slightly inclined so that the supply end is lower than the other end. The pressure in the hose shall be increased gradually at a rate of 0.1 to 0.7 Kg/sq.cm/sec. Test pressure shall be held for a minimum period of five minutes after stabilization. During the entire test period, the hose shall be carefully inspected for signs of leakage, uneven expansion, ballooning, air bubble on external surface due to entrapped air or any other indication of failure. The pressure shall then be released gradually at the same rate.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
7.4 ELECTRICAL CONTINUITY

Hose shall be tested for electrical continuity.

7.5 DISCARDING LIMIT

LPG hoses shall be discarded after 3 years of service or earlier in case the permanent elongation exceeds 5%.

8.0 DOCUMENTATION

Records of the observations, tests, remarks etc. in respect of each hose shall be suitably maintained. These records shall show all details pertaining to origin & manufacture, identification, service history, inspection and maintenance etc. of the hose.

9.0 REFERENCES

i) IS 9573 - Specification for Rubber Hose for LPG.

ii) BS 4089 - Specification for Rubber Hose and Hose Assembly for LPG.

iii) NFPA 58


v) API-2510-Design/Construction of LP Gas Installations.


vii) BS 903 - Methods of testing vulcanized rubber, Part A2, A16, A19 & B2

viii) IS 443 - Method of Sampling & test for Rubber Hoses.
PART C

MARINE HOSES FOR OFFSHORE TERMINALS

1.0 SCOPE

This section covers the material, construction, inspection, storage, testing and handling requirements of Marine Hoses used for transferring petroleum products in offshore terminals.

1.1 DEFINITIONS

The term rubber shall include all types of rubber materials, i.e. natural, synthetic and compounds thereof unless mentioned specifically. Similarly, general mention of yarns and fabrics shall include those made from cotton or man made fibres or combination thereof.

2.0 TYPES OF HOSES

2.1 FLOATING HOSES

Floating hoses are characterised with in-built flotation media to impart positive reserve buoyancy such that these hoses can float without addition of any external floats. Depending on flotation requirements, use and other characteristics, Floating hoses are sub classified as follows:

i) Full Float Hoses

Full float hoses are characterised with minimum positive buoyancy of 20% in sea water with pipe full of sea water.

ii) Half Reinforced/Half Float Hoses

Half Reinforced/Half Float hoses are characterised with positive buoyancy of 5% in sea water. These hoses are used as the first hose off the buoy.

iii) Tanker Rail Hoses

Tanker Rail hoses are characterised with more flexibility, reinforced ends and higher flow velocity in excess of standard velocity of 15 m/sec. The hose is positioned at tanker for manifold connection.

2.2 UNDERBUOY HOSES

Underbuoy Hoses are without any reserve positive buoyancy. However collars may be provided at specific intervals for fixing bead floats for achieving desired configuration while installed under the buoy.

2.3 ONE-END REINFORCED HOSES

One-end reinforced hoses are provided with reinforcement at one end to impart additional stiffness required for connecting to a rigid manifold like Pipeline Manifold/ buoy manifold/buoyancy tank etc.

2.4 ELECTRICALLY CONTINUOUS / DISCONTINUOUS HOSES

To avoid risks such as dangerous build up of static electricity or short circuit of corrosion protection system, the hoses are manufactured either electrically continuous or electrically discontinuous depending upon the location of a hose in the system.

"OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines."
2.5 TAPERED BORE HOSES

Marine hoses are also manufactured with tapered bore, to be used as floating reducers.

3.0 GENERAL REQUIREMENTS

3.1 PRESSURE RATINGS

Hoses shall be designed & manufactured for a minimum rated pressure of 15 Kg/cm². Hoses with higher pressure ratings may be manufactured as per specific customer’s requirements.

3.2 BENDING CHARACTERISTICS

i) Minimum bending radius of hoses shall not exceed 6D where D denotes internal diameter of the hose. For rail-tail hoses and submarine hoses, this limit is 4D. Hoses with lesser bending radius are also available.

ii) Hoses if required with certain specific stiffness values and bending radius may be specified by the customer.

3.3 FLOW VELOCITY

The design flow velocity of liquids inside hoses shall be limited to 15 m/sec.

3.4 TEMPERATURE RATINGS

Marine hoses are manufactured to withstand following ambient temperature range:

Maximum : + 52 deg C (125 F)
Minimum : - 29 deg C (-20 F)

4.0 MATERIAL & CONSTRUCTION OF HOSES

Marine hoses consist of the following:

i) Inner tube

The inner tube shall be made from smooth, seamless, oil resistant synthetic compound. The compound used shall be Nitrile Butadiene Rubber.

ii) Body Wire

Hard drawn steel wire helix welded to end connections shall be used for body wire.

iii) Body Wrap

Body wrap shall be synthetic rubber.

iv) Flotation Medium

Flotation medium shall be Integrally built over basic hose consisting of sponge rubber, PVC or polyethylene foam or similar closed cell material.

v) Outer Cover

Outer cover shall be resistant to aging, abrasion, weathering, tearing, sunlight, oil and sea water penetration and shall extend to the back of flange extension.

"OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines."
vi) Flanged Joint

Both ends shall have ANSI 150 series flat face weld neck forged flange conforming to ASTM A105 steel of maximum 0.25% carbon, with a protective galvanising of minimum 85 micron thickness.

vii) Nipple

Nipple shall be made from steel pipe conforming to API 5L Grade B of maximum 0.23% carbon.

viii) Integral reducers

Whenever hoses are fitted with 150 series integral reduces, they shall conform to ANSI B 16.5.

ix) Colour marking/colour of cover

This may be done as per OCIMF stipulations

5.0 INSPECTION AND TESTING OF HOSES DURING MANUFACTURE

5.1 GENERAL REQUIREMENTS

Each hose shall be subjected to inspection and test at Manufacturer’s shop before acceptance. The inspection shall be carried out as per section 1.11.1 of the “Oil Companies International Marine Forum 1991 Edition” or “Oil Ports Committee’s SBM Hose In-Plant Inspection Guide”.

Inspection at Manufacturer’s shop shall include, but not limited, to the following points.

i) Hydrostatic testing.

ii) Electrical continuity/discontinuity test.

iii) Vacuum test.

iv) Visual inspection.

v) Checking of all test certificates including radiography and mill test certificate of materials.

vi) Bending test.

vii) Adhesion test.

viii) Weight test.

ix) Float Hydrostatic Test

5.2 RECORD OF TESTS

After inspection, the result of all tests and inspection shall be recorded in an ‘Inspection and Test Certificate’ for each hose. This certificate shall include all the relevant details in regard to its compliance with OCIMF standard or any other standard as specified.

5.2.1 Hydrostatic Testing

Each hose shall be tested with water to the test pressure specified to determine water tightness and in addition, shall be pressurised to working pressure to determine temporary and permanent elongation. The hydrostatic test shall be performed as per details given in Annexure-III.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
5.2.2 Electrical tests

The hose shall be tested for discontinuity within the specified level and resistance reading recorded. Resistance level for electrically discontinuous hoses shall be measured utilising a 500 Volt Mega Ohm Meter with a minimum full scale of 25,000 Ohms.

Electrical continuity in hose is tested by a test lamp (4.5 V 0.3A) across both flanges. The resistance should be low enough to light the test lamp.

5.2.3 Vacuum Testing

Each hose shall be subjected to a vacuum test, which shall be conducted last in the sequence of tests. The procedure to be followed shall be as described in Annexure-IV.

5.2.4 Float Hydrostatic Test

Hydrostatic tests will be performed on one float per each size, with minimum of one per order or one per ten if there are more than ten floats in the order. Further details are given in Annexure-V.

5.3 VISUAL INSPECTION

The visual inspection shall be made on each completed length of hose for the following:

i) Physical dimensions should be checked and recorded.
ii) Weight of the hose shall be checked and recorded.
iii) Reserve positive buoyance shall be calculated and recorded.

6.0 PERIODIC INSPECTION AND TESTING OF HOSES

All hoses put in service shall be subjected to periodic testing and inspection for trouble free and safe operation. This includes:

i) Visual inspection of hoses in service.
ii) Periodic hydro-testing of hose string in service.
iii) Periodic inspection of individual hose.

Floating hoses shall be inspected before and after any operation where tankers are unloaded and also after heavy storm. Underwater hoses shall be inspected at least once in 6 months for general condition and string configuration and also after every heavy storm for string configuration.

In case of floating hoses, the first and second hose off the buoy and the tail hoses including tanker-rail hose deserve more attention than other hoses.

Each hose should be examined for any possible defect such as oil seepage, kinking, abrasion exposing the body wire, bending etc. For any such defect, the concerned hose should be replaced immediately.

Other defects of minor nature shall be dealt with according to the severity of the defects. In case of doubts regarding structural damages in the hose, the affected hose shall be removed from service for further and detailed examination.

The hose string should be put to hydrostatic test before resumption of operation after each replacement activity of hose.
Hoses should be checked for possible rubbing against anchor chain. Frequency will vary from 3 to 6 months depending on location.

6.1 PERIODIC HYDRO TESTING OF HOSE STRING IN SERVICE

The hose strings in service shall be tested periodically every three to six months and after every storm to ensure good health of the system.

Testing medium shall be water and test pressure shall be 150% of the maximum working pressure but limited to rated pressure. The system should be able to hold the test pressure satisfactorily for a period of not less than 30 minutes after stabilisation.

Valves in the system may be operated in logical sequence to pinpoint any weak section or a leaking section.

The underwater hose configuration is to be adjusted with oil-filled condition.

6.2 PERIODIC TESTING OF INDIVIDUAL HOSES

Periodic testing of individual hoses (not in a string) should be undertaken as under:

i) New hoses which have been in storage for more than six months and used hoses in which defects are suspected, should be pressure tested at maximum working pressure rating of the hose before being replaced or returned to service. The hydrostatic testing shall be undertaken as per procedure outlined in Annexure-III.

ii) Hoses in service will be taken for testing depending upon results of visual inspection and in-situ testing as covered in 5.0.

iii) If the hoses are required to be used beyond normal working life, the following tests shall be carried out as per OCIMF standard:

   a) Visual
   b) Hydrostatic
   c) Electrical
   d) Vacuum

6.3 SAFE WORKING LIFE TYPE OF HOSES

   - Floating: 3 years
   - Submarine Underbuoy: 3 years
   - Tanker Rail: 1 year
   - First hose off buoy: 1 year

However, safe working life of hose may be altered based on Manufacturer's recommendations and past history records*. Note 3

6.4 VISUAL INSPECTION OF HOSE COMPONENTS

6.4.1 Covers

The primary function of the rubber cover of hoses is to prevent any damage to the reinforcement or flotation material.

Any surface cracking which does not expose the reinforced layer or flotation material, does not call for replacement of the hose.

Any cut, gouge, local abrasion or tear down to or through the cover breaker, but not into the outer reinforced layer, may be repaired as per manufacturer's instruction and returned to service.

---

*“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
Bulging or ridged area should be marked and examined again under pressure. Hardening under pressure indicates a leaking tube or ruptured reinforcement and calls for replacement of hose.

Hoses shall be replaced if localised areas of oil softened rubber are observed.

6.4.2 Flotation Material

Minor damage to flotation material shall be repaired as per manufacturer’s instructions before returning to service.

Hose with considerable amount of floating material missing or with buoyancy decreased excessively due to shrinkage of flotation material shall be replaced. These hoses may be kept in store as emergency spares in case they pass other tests satisfactorily. Adequate number of auxiliary floats may be attached to those hoses before they are put into service again.

6.4.3 Carcass

Hoses with crushed or kinked spots or broken reinforcement as apparent from permanent distortion or separation shall be replaced.

Any hose used for tail, rail, first off the buoy or underwater and having any permanent deformity shall be replaced.

6.4.4 Fittings

The internal & external surface of fittings shall be wiped and inspected with flashlight for cracking or excessive corrosion. Either of these damages shall be a cause for hose replacement.

Any distortion of the nipple and/or flange shall be enough cause for replacement of hose.

Superficial damage to the coatings shall be touched up before the hose is returned to service.

6.4.5 Inner tube

Hose interior shall be inspected for blisters, bulges, or separation of the tube from the carcass. Any of these defects or any tearing, cutting or gouging in the tube shall render the hose liable for rejection from service.

7.0 HANDLING AND STORAGE OF HOSES

The hose strings are critical links in any offshore installation. They are subjected to dynamic loads of wind and sea currents. Hence, to provide greater reliability and longer hose life, it is required that utmost care should be taken during handling and storage so as to ensure no damage to the hose during these stages. Hoses are prone to physical damage. All care must be taken during handling as specified.

7.1 HANDLING INDIVIDUAL HOSE

Individual hose shall be lifted using spreader bars. Minimum three point lift used over nipple area at each end and additional lifting strap equally spaced between the end slings shall be used.

Spreader bars shall be rigid and strong enough to withstand load of individual hose without bending. Spreader bar shall preferably be made of steel pipes or I-Sections of suitable size.

A hose shall never be lifted by a single sling at mid point or by two slings positioned one at each end.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
Lifting strap shall be flat polyester band of minimum 6” width to prevent any chafing of the hose covers. In case of integrally floating hoses, the lifting strap not only eliminates chafing of covers but also eliminates damage of flotation medium due to point loading.

A hose shall never be dragged across the ground. While moving a hose, it must be lifted properly and set down with care on adequate supports.

Unnecessary rotation of hoses while lifting is to be avoided to prevent damage that may be caused due to bumping against building or structures. For this purpose, a string may be attached to one end of the hose.

7.2 HANDLING HOSES IN PALLETES

Steel pallets shall be properly designed so as to hold two or three hoses at a time, preventing any relative movement during lifting or transportation.

Pallets shall be lifted with four point lifts using roped slings (wire rope, nylon rope or chain). Each shall be long enough to prevent their contact with hose cover.

Slings shall be connected correctly with shackles on steel pallets.

7.3 STORAGE OF HOSES

Marine hoses shall be stored in dry area on steel pallets away from sunlight. Where closed storage is not available, hoses shall be covered preferably with a water proof cover.

The storage area shall be protected against rodents and insects.

Storage area should not be adjacent to equipment generating heat and ozone.

Hoses should not be subjected to temperature exceeding 125 deg F (52 deg C) and lower than -20 deg F (-29 deg C).

For storage of used hoses, it shall be drained completely, water flushed thoroughly to remove combustible vapours and stored on the steel pallets. Both ends of hoses shall be kept open to allow free circulation of air.

The records of hoses in store shall be maintained and referred to ensure that the oldest hose is put to service first and rotational sequence is employed.

8.0 DOCUMENTATION

Records of each hose or string, as applicable, shall be suitably maintained. These records shall show all details pertaining to origin and identification, service history, inspection and maintenance etc. of the hose.

9.0 REFERENCES:


iii) Bridgestone Hose Manual.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
PART D

HOSES FOR JETTY OPERATIONS

1.0 SCOPE

This section covers the requirements of inspection and testing of hoses of size 75 mm to 300 mm nominal inner dia, suitable for use in petroleum products having aromatic content not exceeding 25% and with temperature ranging from minus 20 degree C to 80 degree C. This section also does not cover LPG hoses.

2.0 TYPE OF HOSES

i) Loading and unloading hoses.
ii) Bunkering hoses.

3.0 MATERIAL AND CONSTRUCTION OF HOSES

Material and construction should confirm to IS- 8189/1976 or its equivalent.

4.0 INSPECTION AND TESTING OF HOSES DURING MANUFACTURE

4.1 Testing of Rubber Hose

Sample hoses shall be selected at random from the lot and shall be subjected to the following tests:

i) Bend test under maximum working pressure.
ii) Thickness of lining and cover.
iii) Tensile strength and elongation at break for lining and cover.
iv) Accelerated ageing test on lining and cover.
v) Adhesion test on a piece cut from the hose before conducting the bursting pressure test.
vi) Swelling test.
vii) Fuel soluble matter.

These tests shall meet the requirements of IS 8189/1976. In addition, the proof test shall be carried out at 150% of the maximum working pressure for 5 minutes.

4.2 TESTING OF FINISHED HOSE ASSEMBLIES

Following tests shall be carried out on all hoses:

i) Visual inspection and dimensional check.
ii) Electrical continuity
iii) Weight of the hose
iv) Hydraulic pressure test:

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
Temporary elongation under working pressure and permanent elongation shall be checked and recorded. Test pressure shall be as per IS-8189.

v) Vacuum test.

This test shall meet the requirement of IS 8189/1976

5.0 PERIODIC INSPECTION AND TESTING OF HOSES

i) All hoses shall be serially numbered for maintaining service records.

ii) Hoses shall be subjected to hydraulic testing at maximum operating pressure at least once in every six months or after each 1000 pumping hours whichever is earlier as per IS 8189/1976.

The temporary elongation of a used hose under test pressure should not exceed 1.5 times the temporary elongation of the new hose.

During the test, if swelling exceeding 3" dia is observed anywhere on the body of the hose or distortion/elongation more than the prescribed limit is noticed, such hose should be rejected. If any leak at nipple joints or sweating on the body of the hose is observed, such hose should also be rejected.

iii) Hoses shall be checked for electrical continuity.

6.0 INSPECTION & TESTING OF HOSES PRIOR TO USE

The stored hoses shall be subjected to inspection and testing prior to use as follows:

- Visual inspection to detect any abrasion or damage
- Permanent deformation of the hose body during transportation and storage if any, shall be checked.

7.0 STORAGE AND HANDLING

7.1 STORAGE

i) New hoses should be wrapped in hessian cloth over its entire length and flanged ends be protected by oversize circular discs.

ii) Each hose shall be punch marked on the flange with month and year of manufacture, manufacturer’s name and Sr.No. of the hose.

(iii) The hoses shall be laid out straight on solid supports. Light weight hoses should be laid out in such a way that they are not subjected to flattening.

iv) The hoses shall be covered to protect them from sunlight.

v) Before returning a hose to storage after use, it should be completely drained. Hoses after use should be thoroughly flushed with water.

vi) The hoses used in white oil/crude oil should be flushed to remove any potential explosive vapours and stored in such a way that air can circulate freely through them.

7.2 HANDLING

i) New hoses shall not be received in bent position and shall be laid straight on the supports.

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
ii) A hose shall not be lifted from a single point with the ends hanging down. The hose should be supported at least by two slings located near the reinforced ends and a lifting bar should be used.

iii) The hoses shall not be dragged over docks or decks. They should be carried on dollies or rollers or lifted by dericks.

iv) Hoses should not be rolled over more than one revolution. This may twist the body of the hose resulting in snapping of electrical continuity wire of the hose.

8.0 DOCUMENTATION

Records of each hose shall be suitably maintained. These records shall show all details pertaining to origin and manufacture, identification, service history, inspection and maintenance etc. of the hose.

9.0 REFERENCES

i) BS 1435/1975 - Rubber Hose, wire reinforced, for oil Suction and Discharge services.

ii) BS 8189/1976-Specifications for Rubber Hose for oil Suction and Discharge services.

iii) IS 443-Methods of Sampling and Test for Rubber Hoses.
ANNEXURE-I

GENERAL GUIDELINES FOR STORAGE AND HANDLING OF HOSES IN PETROLEUM SERVICE (EXCLUDING MARINE HOSES)

i) Hose assemblies should be laid out straight on solid supports. Light weight hose assemblies in particular should be laid out in such a way that they are not subjected to flattening.

ii) All hose assemblies shall be covered to protect them from sunlight. A cool, dark, & dry storage place is preferred.

iii) All hose assemblies should be marked to indicate the service for which they are to be used, & also whether they have been down-graded from white oil to black oil service. All persons handling hose assemblies should fully understand the marking system and its meaning.

iv) Hose assemblies which are regularly flushed with water after use are expected to give a longer life than those which are left full of oil.

A hose assembly operating at higher flow rates will have a shorter service life than similar hose assembly operating at lower flow rates.

v) A hose assembly in white oil service will have a shorter service life than a similar hose assembly in black oil service.

vi) When water is used as the test medium, drain it thoroughly and dry the hose by blowing air or by hanging before putting to service or storage.

vii) Prevent wire-reinforced or metal lined hose from being crushed, kinked, flattened and the hose should be discarded if any of these damages are noticed.
ANNEXURE-II

GENERAL PROCEDURE FOR HYDROTESTING OF HOSES

i) Any available, reliable, pumping equipment with a by-pass arrangement and capable of producing the required hydrostatic pressure may be used for the test.

ii) Connect the hose assembly under test to the pressure apparatus. Attach a suitable vent valve to the other end of the hose assembly.

iii) Elevate the vent valve, fill the hose and bleed the air.

iv) When the hose is completely filled and all air has been removed from the hose assembly, close the vent valve and anchor hose properly.

v) After the hose is completely filled and anchored, dry the outside of the hose, and slowly raise the pressure. Check the hose for leaks. If couplings leak, release the pressure, tighten the coupling and again raise the pressure slowly.

vi) If the coupling leaks cannot be stopped by tightening tag the hose to show that repairs are needed. Repeat hydrostatic test after repairs have been made.

vii) If the hose leaks because of damaged couplings, then it may be recouped, retested, and returned to service. If the hose leaks through the carcass, tag the hose as faulty and remove from service.
PROCEDURE for HYDROTESTING OF MARINE HOSES

Each hose shall be tested with water to a test pressure of 15 bar gauge (225 psig) unless otherwise specified by the Purchaser. A pressure recorder shall be provided for this test. The test procedure shall be as follows:

i) Lay the hose as straight as possible on supports that permit the hose to elongate freely.

ii) Fill with water, vent to remove all air and raise and lower the pressure 15 times at a rate of 1/2 second per inch diameter of hose per cycle, or as otherwise specified by the Purchaser, from zero pressure to test pressure and inspect nipples for leaks.

iii) Re-apply a pressure of 0.7 bar gauge (10 psig) and measure the overall length of the hose assembly. Designate it as original length.

iv) Increase the pressure over a period of 5 minutes, from 0.7 bar gauge (10 psig) to one half of the rated pressure; hold this pressure for 10 minutes, inspect for leaks, then reduce the pressure over a period of 5 minutes to zero.

v) Raise the pressure over a period of 5 minutes to rated pressure and hold for 10 minutes, inspect for leaks.

vi) Measurement of temporary elongation: Before releasing the full test pressure, measure the overall length of the hose assembly to ascertain the temporary elongation and record the increase as percentage of the original length measured at 0.7 bar gauge (10 psig) in para (iii) above.

vii) Reduce the pressure over a period of 5 minutes to zero.

viii) After an interval of at least 15 minutes, raise the pressure again to 0.7 bar gauge (10 psig).

ix) Measurement of permanent elongation: Measure the overall length of the hose assembly to ascertain the permanent elongation, record the increase as a percentage of original length measured at 0.7 bar gauge (10 psig) in para (iii).
PROCEDURE OF VACUUM TEST FOR MARINE HOSES

This test should be carried out on hoses removed from service for hydrostatic pressure test.

Seal off both ends with transparent Plexiglas plates of sufficient strength using putty as a sealant or bolt up using a soft rubber gasket. One plate shall be fixed for connection to a vacuum source. An inspection mirror using sunlight may also be manipulated from outside the plates to provide a proper light source.

Apply a Vacuum of atleast (-) 510 millibar gauge (15 inches of mercury) and preferably (-) 680 millibar gauge (20 inches of mercury) for a period of 10 (ten) minutes.

Inspect the interior of the hose for blisters or bulges. Blisters, bulges or separation of tube from carcass is a sufficient reason to retire hose from service. Any tear out or gouge through the tube is also reason to retire hose from service.
FLOAT HYDROSTATIC TEST (MARINE HOSES)

Hydrostatic tests will be performed on one float per each size, with a minimum of one per order or one per ten if there are more than ten floats in the order. The test procedure will be as follows:

i) Weigh each half float (without hardware) on scales calibrated for an accuracy of 100 (at the approximate float weight).

ii) Place half float in a pressure chamber filled with water and increase the pressure to 6.5 barg over a five minute period.

iii) Maintain the test pressure of 6.5 barg for a period of 2 hours.

iv) Reduce the pressure to atmosphere over a period of 5 minutes and remove the half float from the pressure chamber.

v) Immediately dry and weigh the half float on the same scale used in step i) above. Any float-half which has gained in weight more than 500 g or has any evidence of deformation or voids in the foam filling will be rejected.

Any float half which has gained more than 250 g but less than 500 g during the test will be retested. Any further gain in weight during the retest will be cause for rejection.